

WHAT IS CLAIMED IS:

1. A method for verifying the integrity of sensor data comprising:
receiving a first data value from the sensor;
comparing a first parameter relating to the first data value to a first threshold value;
receiving a second data value from the sensor;
comparing a first parameter relating to the second data value to the first threshold value;
continuing receipt of data from the sensor when the first parameter relating to the first data value exceeds the first threshold value and the first parameter relating to the second data value does not exceed the first threshold value; and
terminating receipt of data from the sensor when the first parameter relating to the first data value and the first parameter relating to the second data value exceed the first threshold value.
2. The method of Claim 1, wherein the sensor is a glucose sensor.
3. The method of Claim 2, wherein the data value is a blood glucose concentration.
4. The method of Claim 1, further comprising discarding the first data value when the first parameter relating to the first data value exceeds the first threshold value and the first parameter relating to the second data value does not exceed the first threshold value.
5. The method of Claim 1, wherein the first parameter relating to the first data value is a second-order derivative of the first data value, and
wherein the first parameter relating to the second data value is a second-order derivative of the second data value.
6. The method of Claim 1, wherein the first parameter relating to the first data value

is a first-order derivative of the first data value, and

wherein the first parameter relating to the second data value is a first-order derivative of the second data value.

7. The method of Claim 1, further comprising:

comparing a second parameter relating to the first data value to a second threshold value; continuing receipt of data from the sensor when the first parameter relating to the first data value exceeds the first threshold value, the second parameter relating to the first data value exceeds the second threshold value, and the first parameter relating to the second data value does not exceed the first threshold value; and

terminating receipt of data from the sensor when the first parameter relating to the first data value exceeds the first threshold value, the second parameter relating to the first data value exceeds the second threshold value, and the first parameter relating to the second data value exceeds the first threshold value.

8. The method of Claim 7, wherein the sensor is a glucose sensor.

9. The method of Claim 7, wherein the data value is a blood glucose concentration.

10. The method of Claim 7, further comprising discarding the first data value when the first parameter relating to the first data value exceeds the first threshold value, the second parameter relating to the first data value exceeds the second threshold value, and the first parameter relating to the second data value does not exceed the first threshold value.

11. The method of Claim 7, wherein the first parameter relating to the first data value is a second-order derivative of the first data value,

wherein the first parameter relating to the second data value is a second-order derivative of the second data value, and

wherein the second parameter relating to the first data value is a first-order derivative.

12. The method of Claim 1, wherein terminating receipt of data from the sensor occurs when first parameter relating to the second data value exceeds the first threshold value within a predetermined period of time.

13. The method of Claim 7, wherein terminating receipt of data from the sensor occurs when the first parameter relating to the second data value exceeds the first threshold value within a predetermined period of time.

14. The method of Claim 3, wherein the first threshold varies depending on the blood glucose concentration.

15. The method of Claim 8, wherein the second threshold varies depending on the blood glucose concentration.

16. The method of Claim 7, wherein the second threshold varies depending on the blood glucose concentration.

17. A method for filtering data from a sensor comprising:
receiving a plurality of data values from the sensor;
obtaining a quantifier of a variance of a measurement error associated with the plurality of data values; and
filtering the plurality of data values with an adaptive filter,
wherein the quantifier is an input to the adaptive filter.

18. The method of Claim 17, where the sensor is a glucose sensor.

19. The method of Claim 18, wherein the plurality of data values are blood glucose concentrations.

20. The method of Claim 17, wherein obtaining a quantifier comprises formulating a standard deviation of an absolute value of consecutive data points within the plurality of data points.

21. The method of Claim 20, wherein formulating the standard deviation comprises formulating a windowed, unweighted standard deviation.

22. The method of Claim 21, wherein the quantifier is equal to

$$R_k = c * \delta_k + b,$$

where

$$\delta_k = \frac{\sum_{i=k-l}^k \left(|s_i - s_{i-l}| - \frac{\sum_{i=k-l}^k |s_i - s_{i-1}|}{l+1} \right)^2}{l},$$

s_k is a raw signal sampled at a k^{th} discrete time interval and ℓ is a window size of a history of consecutive differences of the raw signal.

23. The method of Claim 20, wherein formulating the standard deviation comprises formulating a recursive, weighted standard deviation.

24. The method of Claim 23, wherein the quantifier is equal to

$$R_k = c * \delta_k + b,$$

where

$$\delta_k = \frac{\sum \left(\alpha_k * \left(|s_k - s_{k-1}| - \frac{\sum (\alpha_k * |s_k - s_{k-1}|)}{\sum \alpha_k} \right)^2 \right)}{\sum \alpha_k - 1},$$

s_k is a raw signal sampled at a k^{th} discrete time interval, α_k is a growing exponential weight: $\alpha_k = e^{((k * \Delta t / 60) / \tau)}$, τ is an exponential time constant in hours and Δt is a sampling time in minutes.

25. The method of Claim 17, wherein the adaptive filter is a Kalman filter.
26. A method for calibrating a sensor comprising:
receiving a plurality of data values from the sensor;
determining the reliability of each data value of the plurality of data values;
discarding data values of the plurality of data values that are unreliable;
filtering the data values of the plurality of data that have not been discarded; and
adjusting an output of the sensor using the filtered data values.
27. The method of Claim 26, wherein the sensor is a glucose sensor.
28. The method of Claim 26, wherein the plurality of data values are blood glucose concentrations.
29. The method of Claim 26, wherein determining the reliability of each data value comprises comparing each data value to a predetermined threshold.
30. The method of Claim 26, wherein determining the reliability of each data value comprises comparing a parameter related to each data value to a predetermined threshold.
31. The method of Claim 30, wherein the parameter is a second-order derivative.

32. The method of Claim 30, wherein the parameter is a first-order derivative.
33. The method of Claim 30, wherein the predetermined threshold varies depending on a current plurality of data values.
34. The method of Claim 30, wherein the current plurality of data values are blood glucose concentrations.
35. The method of Claim 30, wherein discarding data values comprises discarding data values that do not meet a pre-established criterion related to the predetermined threshold.
36. The method of Claim 26, wherein filtering the data values comprises filtering the data values with an adaptive filter.
37. The method of Claim 26, wherein the adaptive filter is a Kalman filter.
38. The method of Claim 36, wherein filtering the data values with an adaptive filter comprises using the adaptive filter with a parameter based on the data values of the plurality of data that have not been discarded.
39. The method of Claim 38, wherein the parameter is a standard deviation of the data values of the plurality of data that have not been discarded.
40. The method of Claim 38, wherein the parameter is a standard deviation of an absolute value of data values within the data values of the plurality of data that have not been discarded.
41. The method of Claim 39, wherein the standard deviation is a windowed, unweighted standard deviation.

42. The method of Claim 39, wherein the standard deviation is a recursive, weighted standard deviation.

43. An apparatus for verifying the integrity of sensor data comprising:
means for receiving a first data value from the sensor;
means for comparing a first parameter relating to the first data value to a first threshold value;

means for receiving a second data value from the sensor;
means for comparing a first parameter relating to the second data value to the first threshold value;

means for continuing receipt of data from the sensor when the first parameter relating to the first data value exceeds the first threshold value and the first parameter relating to the second data value does not exceed the first threshold value; and

means for terminating receipt of data from the sensor when the first parameter relating to the first data value and the first parameter relating to the second data value exceed the first threshold value.

44. The apparatus of Claim 43, wherein the sensor is a glucose sensor.

45. The apparatus of Claim 44, wherein the data value is a blood glucose concentration.

46. The apparatus of Claim 43, further comprising means for discarding the first data value when the first parameter relating to the first data value exceeds the first threshold value and the first parameter relating to the second data value does not exceed the first threshold value.

47. The apparatus of Claim 43, wherein the first parameter relating to the first data value is a second-order derivative of the first data value, and

wherein the first parameter relating to the second data value is a second-order derivative of the second data value.

48. The apparatus of Claim 43, wherein the first parameter relating to the first data value is a first-order derivative of the first data value, and

wherein the first parameter relating to the second data value is a first-order derivative of the second data value.

49. The apparatus of Claim 43, further comprising:

means for comparing a second parameter relating to the first data value to a second threshold value;

means for continuing receipt of data from the sensor when the first parameter relating to the first data value exceeds the first threshold value, the second parameter relating to the first data value exceeds the second threshold value, and the first parameter relating to the second data value does not exceed the first threshold value; and

means for terminating receipt of data from the sensor when the first parameter relating to the first data value exceeds the first threshold value, the second parameter relating to the first data value exceeds the second threshold value, and the first parameter relating to the second data value exceeds the first threshold value.

50. An apparatus for filtering data from a sensor comprising:

means for receiving a plurality of data values from the sensor;

means for obtaining a quantifier of a variance of a measurement error associated with the plurality of data values; and

means for filtering the plurality of data values with an adaptive filter, wherein the quantifier is an input to the adaptive filter.

51. The apparatus of Claim 50, where the sensor is a glucose sensor.

52. The apparatus of Claim 51, wherein the plurality of data values are blood glucose concentrations.

53. The apparatus of Claim 50, wherein means for obtaining a quantifier comprises means for formulating a standard deviation of an absolute value of consecutive data points within the plurality of data points.

54. The apparatus of Claim 53, wherein means for formulating the standard deviation comprises means for formulating a windowed, unweighted standard deviation.

55. The apparatus of Claim 53, wherein means for formulating the standard deviation comprises means for formulating a recursive, weighted standard deviation.

56. The apparatus of Claim 50, wherein the adaptive filter is a Kalman filter.

57. An apparatus for calibrating a sensor comprising:
means for receiving a plurality of data values from the sensor;
means for determining the reliability of each data value of the plurality of data values;
means for discarding data values of the plurality of data values that are unreliable;
means for filtering the data values of the plurality of data that have not been discarded;

and

adjusting an output of the sensor using the filtered data values.

58. The apparatus of Claim 57, wherein the sensor is a glucose sensor.

59. The apparatus of Claim 57, wherein the plurality of data values are blood glucose concentrations.

60. The apparatus of Claim 57, wherein means for determining the reliability of each data value comprises means for comparing each data value to a predetermined threshold.

61. The apparatus of Claim 57, wherein means for determining the reliability of each data value comprises means for comparing a parameter related to each data value to a predetermined threshold.